Scilight

NEWS | JANUARY 18 2023

Complex network analysis unravels early indicators of cyclone merger FREE

Maura Shapiro

Check for updates

Scilight 2023, 031103 (2023)
https://doi.org/10.1063/10.0016994

View Online
Export Citation

24 June 2024 09:44:59

AIP Publishing

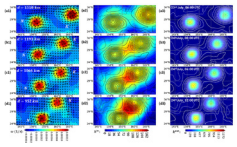
Scilight

18 January 2023

Complex network analysis unravels early indicators of cyclone merger

Maura Shapiro

Novel approach to studying vortical interactions across multiple scales facilitates a deeper understanding of binary cyclone interactions



Cyclones are devastating natural disasters that bring high winds and torrential rains and can result in extreme destruction if they make landfall. As climate change increases cyclone intensity and frequency, the probability of rare binary cyclone events rises. These interactions are rare meteorological phenomena in which neighboring cyclonic vortices interfere and merge.

Traditional models often inaccurately predict the behavior of these systems due to their complexity and immense scale. This can result in inadequate preparation for such storms and increase casualties and infrastructure damage.

De et al. used a complex network approach to represent vorticity fields of known cyclone-merging events and study the indicators of potential outcomes.

“Our data-driven complex network approach uncovers the different transitions in the mutual interaction between the two cyclones, which eventually leads to the merging between the cyclones,” said author Raman Sujith.

The authors used the relative vorticity field at successive time steps to construct complex networks representing binary cyclone interactions. By studying the topological transformation of these networks during the cyclone merger, they were able to extract information about multiscale interactions that evaded previous model-based analyses. Based on these complex networks, the team proposed a new methodology to quantitatively study interactions between the cyclones.

Their model corroborated findings about the influence of cyclone separation distance and revealed other indicators of the interaction stage.

“Such network-based indicators can provide an early warning signal of the occurrence of the cyclone merger,” said Sujith.

This complex network approach can be applied to other binary cyclone interaction outcomes, and can predict cyclone merger events more accurately when combined with machine learning techniques. Understanding the indicators of potential outcomes will enable more accurate predictions and could save lives.

Source: “Study of interaction and complete merging of binary cyclones using complex networks,” by Somnath De, Shraddha Gupta, Vishnu R. Unni, Rewanth Ravindran, Praveen Kasthuri, Norbert Marwan, Jürgen Kurths, and R. I. Sujith, *Chaos* (2023). The article can be accessed at https://doi.org/10.1063/5.0101714.

This paper is part of the Theory-informed and Data-driven Approaches to Advance Climate Sciences Collection, learn more here.

Published by AIP Publishing (https://publishing.aip.org/authors/rights-and-permissions).

24 June 2024 09:44:59